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Blending Teacher-Directed and Student-Centered Approaches in Mathematics Instruction

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Topic: National Math Panel: Critical Foundations for Algebra
Practice: Comprehensive Instruction

Highlights

- Brief overview of the Instructional Practices Task Group
- Discussion of teacher-directed and student-centered instruction
- Importance of blending these instructional approaches
- How cooperative learning and peer-assisted instruction illustrate a blend teacher-directed and student-centered instruction
- Example of how teachers can balance or blend these approaches for teaching fractions
- Importance of teachers' professional wisdom and judgment in making decisions about classroom instruction
- Value of bringing teachers together to learn, observe, reflect, and share wisdom with each other

About the Interviewee

Dr. Joan Ferrini-Mundy served as Ex-Officio Member of the National Mathematics Advisory Panel and as Co-Chair of the Instructional Practices Task Group. She

is the Division Director of the National Science Foundation's (NSF) Division of Elementary, Secondary, and Informal Education, in the Directorate for Education and Human Resources. In this role she supports NSF's mission of providing leadership and promoting development of the infrastructure and resources needed to improve pre-Kindergarten through twelfth grade science, technology, engineering, and mathematics education throughout the United States. While on assignment at NSF, Dr. Ferrini-Mundy serves as a University Distinguished Professor of Mathematics Education at Michigan State University (MSU) and Associate Dean for Science and Mathematics Education in the College of Natural Science. She is a professor in the Departments of Mathematics and Teacher Education.

Ferrini-Mundy's research interests include calculus teaching and learning, the development and assessment of teachers' mathematical knowledge for teaching, and the improvement of student learning in K-12 mathematics. She has played leadership roles in several MSU-based projects, including the Carnegie-supported Teachers for A New Era Initiative, the NSF-funded Knowledge of Algebra for Teaching project, and Promoting Rigorous Outcomes in Mathematics/Science Education (PROM/SE), an NSF Mathematics and Science Partnership.

Full Transcript

I am Joan Ferrini-Mundy and I work currently at the National Science Foundation as Director of the Division of Research on Learning in Formal and Informal Settings.

I served on the instructional practices subgroup and worked as co-chair of that group toward the end of the time of the Panel. One of the ways that the instructional practices group decided to work was to identify issues that were really of interest and importance to the field, and/or were subject to a lot of debate in the field. One of these had to do with the issue of what we called, and what others have called, "teacher-directed instruction" and "student-centered instruction." And the task force took up these two topics, because we have heard a lot about debate and also local policy that is encouraging teachers to use exclusively one or the other of these particular instructional styles. So teacher-directed instruction is taken to mean, by some at least, as instruction where the teacher is absolutely at the center; is organizing, orchestrating, directing, and managing the communications in a sort of unidirectional way from teacher to student. That's, I guess, I would say, an extreme view of something that we have called teacher-directed instruction. Student-centered instruction, very much a focus in certain kinds of policy and professional guidance documents today, is a style of instruction that, in its extreme form, might almost be interpreted as students teaching each other. Now, of course, there are variants of this and a more moderate definition might be a form of instruction that takes the students' thinking and the students' ideas as central and uses them as the jumping off point for mathematics instruction.

When our task force took a look at the research that had very carefully tried to examine one or the other of these styles in comparison with either the other style or something else, we found basically that

there is no evidence in the research to advocate for exclusive use of one or the other of these styles of instruction. Now, experienced teachers know that rarely would it ever be logical to use either one of these styles exclusively; that in a dynamic classroom with an experienced teacher, a mixture of these styles is typically what one would see, where a teacher might begin a lesson by actually explaining something to the students very clearly and then might continue the lesson by asking the students to work in pairs to explore some idea or to apply the thing that has just been explained. The lesson might conclude, then, with the teacher summarizing or pulling the ideas together again in a whole group setting. Now, that would be a blend of teacher-directed and student-centered instruction. The Panel wanted to be clear that policy recommendations or procedures for evaluating teachers shouldn't assume that one or the other of these styles of instruction is the only thing that should be happening in the classroom.

The Panel also looked at, within this topic, at issues of cooperative learning and peer-assisted instruction. Both of these have been construed largely as student-centered approaches and what we found in the research is that, in fact, even these two methods have their blend of student centeredness and teacher directedness. Teachers choose the problems. Often, teachers work from assessment information that gives them guidance about where to go with the students as they work in their peer-assisted groups or in their cooperative groups. And so these two techniques have been studied fairly thoroughly by researchers and, again, the findings would suggest that some kind of a mix is generally what will make the most sense for teachers and for students.

So, in coming up with an example of what it might mean for a teacher to use a balance of teacher-directed and student-centered instruction, I was thinking about the addition of fractions with unlike denominators, which moves from something that students might have mastered—the addition of fractions with like denominators—to something that is a step beyond. And one could imagine a teacher actually beginning a lesson on that topic by presenting a challenge of adding together two fractions that have unlike denominators—you have a fifth of a pizza and a fourth of a pizza, and how much of the pizza does that make? And even leaving students to explore in pairs, for example, some different ways of coming to an answer and even giving them some tools for doing that, ways of drawing sketches, perhaps some kind of manipulative or concrete object that they could use to try to examine this question. But a teacher might not let that go on for a long time if students seem to be struggling. So, the teacher's role in circulating around the classroom, listening to what the students are saying, using it as an assessment opportunity to gather information about what the students bring to the problem and how many resources they really have intellectually to handle the problem; but then to pull together that discussion into a whole-class direct instruction piece that might really involve the teacher on the fly. Being able to say, "You know, I heard Susie say this, and I heard Joey say that, and let's think about these methods," and then pull that together into an actual explanation of a method for adding fractions with unlike denominators that would build upon what the students have tried to understand, but that hadn't allowed the students to explore sort of unfettered for too, too long in an area that might have been frustrating; and to then bring that together and perhaps

to close with an actual problem that would require the students to apply this method. Again, a blend that would involve very careful listening to students and their understandings and then designing instructional moves based on those understandings.

So the task group report notes that instructional practice should be informed by the best available research, and by the professional judgment of accomplished teachers. So it's not surprising that research would give us some partial answers but certainly not comprehensive answers to what will work best, under what conditions, with what children, and with what materials. So we wanted to make clear that teachers aren't supposed to sort of sit back and wait until all of the research is available and ready to give them very explicit guidance, but rather, to keep doing the good work they do, have it be informed by research as possible, but also to share and codify more fully their own professional wisdom. Teachers bring extraordinary professional wisdom to their work and that that needs to be part of the literature and part of the discussion, part of the discourse for improving mathematics teaching and learning. So what we would mean by this in practice, I guess, is that one would hope teachers would have access to and be looking at research findings or translations of research findings that could be useful in their decisions about how to construct their instructional practice, but at the same time, to really operate in a way that allows them to learn from one another, to observe one another, to engage in reflective analytic discussion of what's happening in each other's classrooms and learning to share the wisdom that their colleagues bring to the act of teaching. There also are publications that are not research publications, but that document and summarize teachers' efforts to teach particular topics in mathematics, and those can also be sources of professional wisdom. What I hope teachers might do would be to find ways to actually look at the report itself, to take a look at even the very large subgroup reports that are available, and work through some of those pieces together with colleagues perhaps in inquiry group settings or in professional development settings, because it is a way into the research.